Chapter 1

$$\vec{v}_{avg} = \frac{\Delta\vec{d}}{\Delta t}$$

$$\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$

$$\Delta\vec{d} = \left(\frac{\vec{v}_1 + \vec{v}_2}{2}\right)\Delta t$$

$$\Delta\vec{d} = \vec{v}_1\Delta t + \frac{1}{2}\vec{a}\Delta t^2$$

$$\Delta\vec{d} = \vec{v}_2\Delta t - \frac{1}{2}\vec{a}\Delta t^2$$

$$\vec{v}_2{}^2 = \vec{v}_1{}^2 + 2\vec{a}\Delta d$$

$$\vec{F}_g = m\vec{g}$$

$$\vec{F}_{net} = m\vec{a}$$

$$F_f = \mu F_n$$

$$F_g = \frac{Gm_1m_2}{r^2}$$

Chapter 2

$$R = \frac{v^2 \sin 2\theta}{g}$$

$$\vec{v}_{og} = \vec{v}_{om} + \vec{v}_{mg}$$

$$a_c = \frac{v^2}{r}$$

$$a_c = \frac{4\pi^2 r}{T^2}$$

$$a_c = 4\pi^2 r f^2$$

$$F_c = \frac{mv^2}{r}$$

$$F_c = \frac{m4\pi^2 r}{T^2}$$

$$F_c = m4\pi^2 r f^2$$

$$F_{g||} = mg \sin\theta$$

$$F_{g\perp} = mg \cos\theta$$

$$\mu = \tan\theta$$

$$\frac{v^2}{gR} = \tan\theta$$

Chapter 3

$$\tau = rF_{app} \sin\theta$$

$$\text{Stress} = \frac{F}{A}$$

$$\text{Strain} = \frac{\Delta L}{L}$$

Chapter 4

$$\vec{p} = m\vec{v}$$

$$\vec{F} = \frac{\Delta\vec{p}}{\Delta t} = \frac{m\Delta\vec{v}}{\Delta t} = m\vec{a}$$

$$\vec{J} = \Delta\vec{p} = \vec{F}\Delta t$$

$$\Delta\vec{p}_{total} = 0$$

$$\vec{p}_{total_{initial}} = \vec{p}_{total_{final}} = \vec{p}_{cm}$$

Chapter 5

$$F = kx$$

$$W = F\cdot\Delta d = F\Delta d \cos\theta$$

$$E_k = \frac{1}{2}mv^2$$

$$E_e = \frac{1}{2}kx^2$$

$$E_k = \frac{p^2}{2m}$$

$$E_{total} = E_p + E_k$$

$$\Delta E_g = mg\Delta h$$

$$P = \frac{E}{t} = Fv$$

$$v_{1_f} = v_{1_o}\left(\frac{m_1 - m_2}{m_1 + m_2}\right)$$

$$v_{2_f} = v_{1_o}\left(\frac{2m_1}{m_1 + m_2}\right)$$

Chapter 6

$$E_p = \frac{-GMm}{r}$$

$$v_{esc} = \sqrt{\frac{2GM}{r}}$$

$$E_T = \frac{-GMm}{2r}$$

$$\frac{r^3}{T^2} = K$$

$$a = -\left(\frac{k}{m}\right)x$$

$$F = -kx$$

$$E_p = \frac{1}{2}kx^2$$

$$E_T = \frac{1}{2}kA^2$$

$$kA^2 = mv^2 + kx^2$$

Chapter 7

$$s = r\theta$$

$$\omega = \frac{\Delta\theta}{\Delta t}$$

$$v = r\omega$$

$$a = r\alpha$$

$$\alpha = \frac{\Delta\omega}{\Delta t}$$

$$a = r\omega^2$$

$$\alpha = \frac{\omega_2 - \omega_1}{\Delta t}$$

$$\Delta\theta = \frac{1}{2}(\omega_1 + \omega_2)\Delta t$$

$$\Delta\theta = \omega_1\Delta t + \frac{1}{2}\alpha\Delta t^2$$

$$\Delta\theta = \omega_2\Delta t - \frac{1}{2}\alpha\Delta t^2$$

$$\omega_2{}^2 = \omega_1{}^2 + 2\alpha\Delta\theta$$

$$\tau = \vec{r} \times \vec{F} = rF \sin\theta$$

$$\tau = I\alpha$$

$$I_{total} = I_{cm} + ml^2$$

$$W_R = \tau\theta$$

$$E_{k_{rotational}} = \frac{1}{2}I\omega^2$$

$$L = I\omega$$

$$\Sigma I_i\omega_i = \Sigma I_f\omega_f$$

Chapter 8

$$F = \frac{kq_1q_2}{r^2}$$

$$\vec{F}_e = q\vec{\mathfrak{E}}$$

$$\vec{\mathfrak{E}} = \frac{kq_m}{r^2}$$

$$\Delta V = \frac{\Delta E_e}{q} = \frac{W_{12}}{q}$$

$$\frac{1}{2}mv_2^2 = q(V_1 - V_2)$$

$$E_e = \frac{kq_1q_2}{r}$$

$$\mathcal{E} = \frac{V}{d}$$

$$V = \frac{kq}{r}$$

Chapter 9

$$F = BIL \sin\theta$$

$$B = \frac{\mu I}{2\pi r}$$

$$B = \frac{\mu NI}{2r}$$

$$B = \frac{\mu NI}{L}$$

$$F = qvB \sin\theta$$

$$m = \frac{qB^2r^2}{2V}$$

Chapter 10

$$T = \frac{1}{f}$$

$$v = \lambda f$$

$$c = \lambda f$$

$$y = A \sin\theta$$

$$x = A \cos\theta$$

$$n = \frac{c}{v}$$

$$n_1 \sin\theta_1 = n_2 \sin\theta_2$$

$$I_1 = \frac{1}{2}I_0$$

$$I_2 = I_1 \cos^2\theta$$

$$\tan\theta_B = \frac{n_2}{n_1}$$

Chapter 11

Double Slit and Diffraction Grating

$$m\lambda = |P_mS_2 - P_mS_1|$$
(constructive interference)

$$m\lambda = d \sin\theta_m$$

$$m\lambda = \frac{dx_m}{L}$$

$$\left(m + \frac{1}{2}\right)\lambda \text{ (destructive interference)}$$

$$\lambda = \frac{d\Delta x}{L}$$

$$R = Nm = \frac{\lambda}{\Delta\lambda}$$

$$\lambda_m = \frac{\lambda}{n_m}$$

$$\Delta PD = \left(\frac{2t}{\lambda}\right)(n_m - 1)$$

Single Slit

$$m\lambda = w \sin\theta_m$$
(destructive interference)

$$m\lambda = \frac{wx_m}{L}$$

$$\left(m + \frac{1}{2}\lambda\right) \text{ (constructive interference)}$$

$$\lambda = \frac{w\Delta x}{L}$$

$$\theta_R = \frac{1.22\lambda}{d}$$

$$m\lambda = 2d \sin\theta$$

Chapter 12

$$\lambda_{max} = \frac{2.898 \times 10^{-3}}{T}$$

$$E = hf = \frac{hc}{\lambda}$$

$$E_{k_{max}} = E_{photon} - W_0$$

$$p = \frac{h}{\lambda}$$

$$E_{x\text{-ray}} = hf_f + \frac{1}{2}mv^2$$

$$\Delta p_y \Delta y \geq \frac{h}{2\pi}$$

$$\Delta E \Delta t \geq \frac{h}{2\pi}$$

$$L_n = mv_nr_n$$

$$r_n = \frac{\hbar^2n^2}{m_eke^2}$$

$$r_n = \frac{5.29 \times 10^{-11}\text{ m}}{n^2}$$

$$E_n = \frac{-2.18 \times 10^{-18}\text{ J}}{n^2}$$

Chapter 13

$$t = \frac{t_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$L = L_0\sqrt{1 - \frac{v^2}{c^2}}$$

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$p = \frac{m_0v}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$E = mc^2 = \frac{m_0c^2}{\sqrt{1 - \frac{v^2}{c^2}}} = m_0c^2 + E_k$$

$$E = m_0c^2 + qV \text{ (linacs)}$$

$$(mvc)^2 + (m_0c^2)^2 = (mc^2)^2$$

$${}_A\vec{v}_c = \frac{{}_A\vec{v}_B + {}_B\vec{v}_C}{1 + \frac{{}_A\vec{v}_B \cdot {}_B\vec{v}_C}{c^2}}$$

$$(\Delta s)^2 = c^2(\Delta t)^2 - (\Delta x)^2$$

$$r = \frac{m_0v}{Bq\sqrt{1 - \frac{v^2}{c^2}}}$$

Chapter 14

$$\Delta m = \frac{\Delta E}{c^2}$$

$${}^A_ZX \rightarrow {}^{A-4}_{Z-2}Y + {}^4_2He$$

$${}^A_ZX \rightarrow {}_{Z+1}{}^AY + {}^0_{-1}e + \bar{\nu}$$

$${}^A_ZX \rightarrow {}_{Z-1}{}^AY + {}^0_1e + \nu$$

$${}^A_ZX + {}^0_{-1}e \rightarrow {}_{Z-1}{}^AY + \nu$$

$$N = N_0\left(\frac{1}{2}\right)^{\frac{t}{T_{\frac{1}{2}}}}$$

$$r = 1.2\sqrt[3]{A} \text{ (fm)}$$

$$\text{Activity} = \frac{0.693N}{T_{\frac{1}{2}}}$$